AD-A162 571 GEONAMES PROCESSING SYSTEM FUNCTIONAL DESIGN SPECIFICATION VOLUME 5 PERFO (U) NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY NSTL STATION MS G LANGRAN

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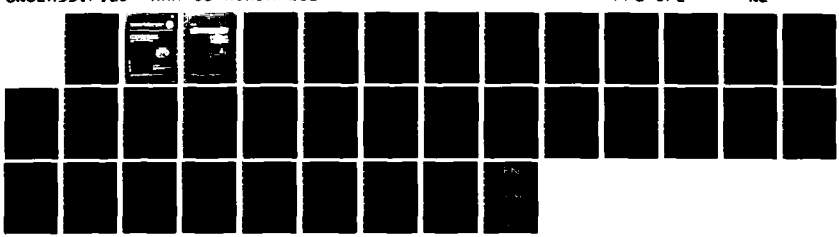

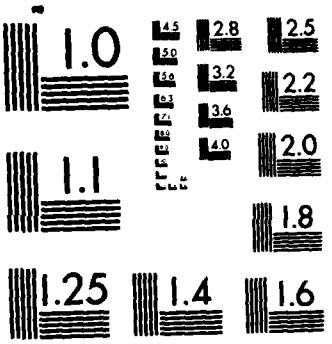

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2.7.3 Device Responses

The echo response to key depressions shall be immediate, about 50 msec. For minor actions, the reponse times shall be about 1 sec., but 2–4 sec. are tolerable. The response time for major actions (rearrange display or reformat a graph) are (and the user typically expects) longer and more variable, up to 10 sec.

2.7.4 Tasks and Feedback

Each task must have a definite beginning and end. After each task the system must return to a clearly defined "home state." The sequence in which information is presented shall be logical, in terms of the display itself and in terms of the user's task.

Spacing and blanks in a display are important to maintain logical sequencing, to reduce clutter, and to aid in recognition of items of information. Within a given action the user should only need to focus or concentrate on one given area of the screen.

It shall be possible for the experienced operator to suppress lengthy and repetitive menus, even though they are deemed appropriate for the novice.

EXECUTIVE SUMMARY

In FY82, the Pattern Analysis Branch, Mapping, Charting and Geodesy Division of the Naval Ocean Research and Development Activity (NORDA) began work for the Defense Mapping Agency (DMA) on four interrelatet aspects of computer-assisted geographic names processing:

- digital capture of names and named feature information from analog sources such as maps and gazetteers;
- adaptation of a data base management system for a very large, product-independent set of world geographic names and their descriptors to support a variety of DMA products and applications;
- word and symbol processing to include editing text with diacritics and special symbols, and document formatting;
- digital type layout on maps, gazetteers, and other DMA products with the associated data selection, formatting, scaling, and type generation.

DMA's four original requirement statements are in Appendix B.

This work, referred to as the Geonames Processing System, will be conducted during FY82-FY89. A Comprehensive Coordination Plan (Norda Technical Note 189) was written in FY82 to provide a general system description. The Geonames Processing System Functional Design Specification, of which this is Volume 5, describes in more detail a proposed system based on requirements presented to NORDA by DMA Headquarters and DMA's two production centers.

Concurrent and related development by DMA's Special Program Office for Exploitation and Modernization is not considered in this set of reports. Rather, a comprehensive system with simple and adaptable standard interfaces is described.

This volume outlines the performance specifications of the Geonames Processing System as a whole. Stated requirements are either shared by all four subsystems, or are developmental functions.

ACKNOWLEDGMENTS

This work was sponsored by DMA under Program Element 64701B, with subtask title, "Geonames Processing System." Dennis Franklin and Lt. Col. Tom Baybrook, both of DMAHQ/STT, shared project management duties during the writing of this report. Their help in communicating with DMA's production centers and providing information on DMA production methods was instrumental to this functional design. Dr. Don Durham, head of NORDA's Mapping, Charting, and Geodesy (MC&G) Division, and Dr. Charles Walker, head of the MC&G Division's Pattern Analysis Branch, contributed valuable advice and assistance.

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INTRODUCTION

a. Organizations

Defense Mapping Agency Headquarters (DMAHQ)
U.S. Naval Observatory
Washington, D.C.

Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC)
6500 Brookes Lane
Washington, D.C.

Defense Mapping Agency Aerospace Center (DMAAC)
3200 South Second St.
St. Louis, Missouri

b. Scope

The purpose of this report is to describe system attributes, serving as a basis for mutual understanding between the user and the developer.

The Geonames Processing Subsystems are often referred to in this report by their acronyms: ASP (Advanced Symbol Processing); ATP (Advanced Type Placement); GNDB (Geographic Names Data Base); and AADES (Automated Alphanumeric Data Entry System).

c. Background

In FY82 the Pattern Analysis Branch, Mapping, Charting, and Geodesy Division of the Naval Ocean Research and Development Activity (NORDA) began a subtask for the Defense Mapping Agency (DMA) entitled "Advanced Type Placement and Geonames Data Base System Development," a project encompassing the digital capture, storage, edit, and display of geographic names. The subtask in its current form is an amalgamation of four previous DMA requirements for independent development of a geographic names data base, a system for high-volume geographic names data capture, advanced word and symbol processing, and automated type placement for maps (see Appendix B for DMA's original requirement statements). A Comprehensive Coordination Plan was submitted by NORDA as a preliminary definition of the overall Geonames Processing System subtasks and their interfaces.

d. Description

The complete Geonames Processing System is comprised of four components (Fig. i-1).

- The Automated Alphanumeric Data Entry System provides a means of high-volume geographic names data capture. World geonames with their corresponding locations and attributes will be captured from both tabular and map/chart sources using raster scan and optical character reading technologies. AADES converts alphanumeric data into computer-readable form with a 99% accuracy rate. It requires minimum operator intervention, provides automated error checking, and results in clean data files for supervised merging with the GNDB.

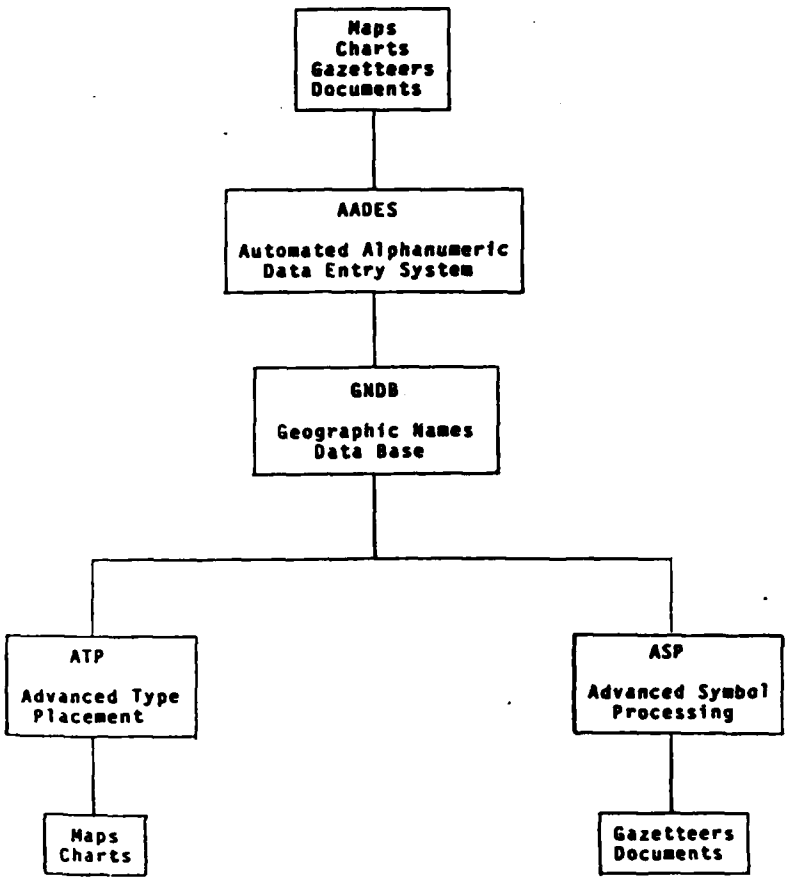

Figure i-1. Geonames Processing System overview

- Geographic Names Data Base stores world geonames and their descriptors in non-product-oriented files. It provides extensive query capabilities to support data base updates, chart and gazetteer compilation, and toponymic research. The GNDB's ultimate size will be 50-100 million geonames.

- Advanced Symbol Processing. International geonames comprised of diacritics and special symbols require specialized hardware and software for access, manipulation, and editing. ASP provides alphanumeric edit and display of world geonames and advanced word processing capabilities such as sorting, searching, and formatting.

- Advanced Type Placement automates the production of map names overlays by exploiting electronic display technology and the rule-based nature of cartographic names placement. ATP includes automated utilities for names selection, type composition, type placement, virtual map display, and interactive graphic edit.

The Geonames Processing System responds to a major need: it will integrate DMA's names processing tasks into the digital map production pipeline and coordinate all geonames processing activities. Obvious benefits are increased production rates and lowered costs. Overall accuracy and coverage should also improve with the increased efficiency of such a system. Helpful utilities will raise toponymic

researchers' productivity levels. Further automation will be easier to implement once the process is converted from manual to digital.

This Performance Specification states the requirements shared by all four Geonames Processing System. Section 1 describes software requirements. Section 2 states human factors engineering criteria. Documentation is discussed in Section 3 and in Appendix B. Acceptance testing and system maintainability are covered in Sections 4 and 5, respectively. Personnel impacts and training are discussed in Sections 6 and 7. miscellaneous requirements are stated in Section 8. Appendix C discusses methods of handling non-Romanized names.

e. Applicable Documents

The following references provide a summary of the basis for the Geonames Processing Subtask development.

- "Advanced Type Placement and Geonames Database: Comprehensive Coordination Plan." NORDA Technical Note 189, January 1983.
- "A Prototype Geographic Names Input Station for the Defense Mapping Agency." Paper presented at Auto Carto IV by D.R. Caldwell and D.E. Strife, September 1982.
- "Names Type File System." Consulting Report for the U.S.A.E.T.L Project #POO13, April 1983.
- "Development of an Automated Cartographic Capability." The Final Report of the Automated Cartography Task Force, Defense Mapping Agency Hydrographic/Topographic Center, April 1982.
- "The Feasibility of Establishing an Automated Chart Production Process." The Defense Mapping Agency Hydrographic/Topographic Center, October 1982.

f. Limitations

The individual subsystem descriptions are functional and not physical definitions, i.e.:

- a given function required by a given subsystem may not be performed upon the hardware logically associated with the subsystem,
- one software module may serve several of the subsystem functional requirements.

Thus the functions and data sets specified in this five-volume set of design specifications are described somewhat redundantly to fully define each subsystem regardless of its interplay with other subsystems. Physical (hardware and software) synthesis will be accomplished and described by the Implementation Plan at a later date.

1.0 SOFTWARE REQUIREMENTS

1.1 Systems Software

Systems software includes the operating system, compilers, assembll rs, file management, and tools or software packages developed or acquired under this contract for software development, update, or maintainance.

1.1.1 General Requirements

Compatibility is required between the software and the hardware. System software must include all executable code. A source tape and program listings of the operating system are preferred; this is not, however, a requirement. I/O packages for each device on the system are to be included as part of the operating system. Executable code for all software must be delivered in both disk and magnetic tape format. Errors found in the software shall be corrected by the developer for twelve months after acceptance.

Technical reference manuals containing a complete description of each software module must be provided. The developer shall issue amendments to the technical reference manuals.

1.1.2 Operating System Software

The operating system shall be a disk oriented, multi-programming, real-time system. The operating system must:

- load and execute disk library programs,
- add and delete library programs,
- maintain library,
- interface with operator through assignable devices,
- control all standard peripheral equipment,
- address logical files through program or operator assignment,
- block and unblock data records,
- generate a cross reference table,
- interrupt driven, concurrent operation of slow-speed peripherals or data communications equipment, and
- compile, assemble, link, and load programs in real-time while executing other tasks.

1.1.3 Assembler

If an assembler is required, a macro processor must be included. Source language shall provide operation codes, assembly directed pseudo-coding and symbolic addressing. The assembler program must:

- print out and assign storage for user-defined symbols,
- flag illegal instruction and coding errors,
- allow for alphanumeric literals, and
- permit assignment of symbolic addressing to specific relative or absolute storage locations.

1.1.4 Higher Level Programming Language

The system shall include at least one higher level language compiler. This compiler must be fully compatible with the operating system requirements stated in Section 1.1.2. The programming language must:

- read and write a multiple disk file with interleaved records residing on one or more disks,
- access any peripheral devices through system support utilities in a device-independent mode,
- operate with a multi-level segmented (overlay) program using both disk-resident and memory-resident segments,
- allow assembly language calls or function overlays from programs that permit assembly language character or byte manipulation, and access to system device handlers, or handle these functions via specialized instructions,
- use all CPU memory not used by the operating system,
- accept in-line assembly language routines, or function overlays,
- allow reading or writing of unformatted binary tapes from other computers, such as an equivalent to "buffer in" or "buffer out" statements,
- allow reading or writing of tapes containing industry standard format ASCII,
- write and read random and sequential files, both fixed and variable length, as well as formatted and unformatted.

Applications routines must not be written in assembler language when they reasonably could be coded in a higher level language.

1.1.5 Utilities

The following utilities shall be provided as a part of the operating system software.

1.1.5.a File Manager

The file manager is for creating, reading, writing, duplicating, and purging named files. It includes capabilities to:

- read and write files and records;
- read and write fixed-length, variable-length and undefined length records;
- allocate multiple disk files to a job and have these files open for access simultaneously;
- make device drivers core-resident for support of selected programs.

1.1.5.b Text Editor

The text editor interactively edits programs and files.

1.1.5.c Debuggers

Debuggers are used by programmers. Complete documentation of debuggers and other such aids is required.

1.1.5.d Scientific Library

The scientific library must be callable from the high-level programming language. It must include a listing of all functions, including a description of each function and its accuracy limitations.

1.1.5.e Fill Copy/Dump Utilities

Routines for input/output and data transfer from one device to another, for all applicable devices must be provided.

1.1.6 Graphics Display Software

The graphics software package shall include all drivers needed to interface the device with the specific computer. Graphics routines shall be accessed efficiently through program calls.

1.2 Applications Software

The functional specifications of the applications software used by individual systems are described in the other four volumes of this Functional Design Specification.

All applications software necessary for the operation of the Geonames Processing System shall be provided. The programs must be modular, use top-down structured programming techniques and be coded in a high-level programming language to the maximum extent possible. There shall be a minimum of assembly language employed. Both source and executable code for all applications software programs shall be delivered. These programs shall be documented in accordance with [1] to include at a minimum the Users Manual (Part 2, 2.4.6), the Functional Description (Part 2, 2.4.1), the Program Specification (Part 2, 2.4.4), the Computer Operation Manual (Part 2, 2.4.7), and the Program Maintenance Manual (Part 2, 2.4.8).

Interactive applications software shall be operator oriented. Printed outputs shall be clearly formatted and labeled. Program options shall be resolved via software interaction with analysts at their workstations or consoles. It shall be possible to interrupt a program to change an option.

The software/firmware shall automatically guard against accidental damage to any system component due to software or control key error. All operator error codes shall be output to the appropriate workstation or console as clear diagnostic messages. The system shall have a means of easy recovery from operator error (e.g., wrong function key hit).

When an analyst tries to delete or modify significant portions of the data being treated, the software will require the command to be entered twice to allow the analyst to double check his intentions before the action is implemented.

1.3 Diagnostic Software

1.3.1 CPU/Peripheral Diagnostics

A complete set of diagnostic programs for determining problems in the CPU and peripherals must be provided along with reference manuals to facilitate periodic testing by the operator and maintenance personnel.

1.3.2 Edit System Diagnostics

Diagnostic programs shall be supplied that systematically test all special hardware (graphic tablets, function keyboard, etc.). This software shall locate malfunctions to the least replaceable unit (LRU).

1.3.3 Microdiagnostics

In keeping with state-of-the-art requirements, "Maintenance Microdiagnostic" programs are to be proposed when applicable. These programs shall provide for individual integrated circuit testing wherever possible. Development of new microdiagnostics for the Geonames Processing System will not be required.

2.0 HUMAN FACTORS ENGINEERING

2.1 Introduction

The Geonames Processing System shall be operable and maintainable in a comfortable, efficient, effective and safe manner. Human factors engineering standards as set forth in military specifications must be applied through all phases of equipment design, development, and test.

The objectives of human factors engineering are efficient, effective and safe performance by operator, control and maintenance personnel; to minimize skill and personnel requirements and training time; a reliable the man-machine interface; and design standardization within and among systems.

To accomplish the above objectives, system developers will insure that human engineering standards are being followed. They must examine the facilities and environment in which the system will be used and recommend work space arrangement. For easy system use, developers must prepare operator and maintenance manuals and training plans, and modify documentation if there are design changes.

Ease of use, operator convenience, and error-prevention shall be primary considerations of the hardware and software design of the Geonames Processing System. The physical configuration of the hardware components of a workstation shall be designed to facilitate comfort and ease of long term operation. An operator may be using the system several hours at any one time. Consequently, the system environment shall be designed to minimize operator fatigue.

2.2 Human Engineering Criteria

The requirements set forth in MIL SPEC 1472C, "Human Engineering Design Criteria for Military Systems, Equipment and Facilities" [15] shall be followed.

Should it become necessary to deviate from human engineering standards in MIL SPEC 1472C or if there are human engineering problems which cannot be resolved, a request for changes or guidelines will be sought from the Defense Mapping Agency.

2.3 Visual Displays

Ideally, the visual display devices shall be large with high resolution and very low distortion, jitter, and noise for optimal visual detection of anomalies and discrepancies and accurate data modification. Relatively fast write and erase times are required to reduce task execution times.

Some of the critical human factors considerations that should be considered for the display device are:

- resolution,
- number of shades of gray (or color, if applicable),
- size of display,
- fineness of grid (related to resolution),
- response rate,
- write and erase speeds,
- number, size, and legibility of characters and symbols,
- selective erase,
- pan and zoom characteristics,

- image distortion,
- image drift, jitter, and flicker,
- adjustable contrast and brightness,
- viewing distance,
- viewing angle,
- registration, and
- nonglare screens or hoods.

2.4 Interactive Inputs and Cursor Controls

Various interactive input and pointing devices are required, including a standard keyboard, a set of function and mode keys, and controls for manipulating displays and cursors.

2.4.1 Keyboard, Function, and Mode Keys

A standard keyboard shall be provided for interactive communications with the computer and text processor. This keyboard shall be movable within a short range of the displays. Function keys shall be logically arranged and conveniently located relative to the keyboard and display.

2.4.2 Cursor Controls

In designing the cursor controls, the following should be considered:

- ability to locate, pick, draw, move items, input values, etc.;
- ease of manipulating and moving controls;
- speed of cursor movement;
- accuracy of cursor positioning;
- facility for making small incremental moves;
- device location.

2.5 Workstation Design

The criteria in paragraph 2.2 shall be met in the workstation designs. Space must be allowed for reference materials, photography, manuscripts, hardcopy plots, reports, etc.

2.6 Editor/Task Considerations

Important editor characteristics are:

- visual acuity,
- visual fatigue susceptibility,
- hand/eye coordination,
- alertness,
- detection skills,
- motivations,
- knowledge of tasks and subtasks,
- knowll dge of anomalies and discrepancies,
- knowledge of symbol meanings,
- cartographic skills and knowledge.

Important task considerations are:

- complexity of task and subtasks,
- time to complete task and subtasks,
- complexity of visual displays,
- demands on cartographic abilities,
- demands on artistic abilities,
- accuracy required,
- feedback of results,
- ability to recall orginal data.

2.7 Interactive Software

The following guidelines are tailored to the needs of the system. The system's users will not always be sophisticated in computer interactions or "computer oriented," and consequently these guidelines, which are intended to apply to these types of users, will be especially helpful to planners. Software guidelines are detailed; hardware ones are not, since workstations will have standard configurations and editor interaction with them will be straightforward (as long as human engineering standards have been met).

System software shall be designed to minimize human error, maximize operator productivity, and ease the task of training new operators. Command entry shall be simple, requiring a minimum of key strokes, button pushes, etc., and following a logical sequence. Typed commands should be mnemonic, i.e., related to their English verbs and nouns, with a minimum of artifical language. Command logic shall be related to the practices of toponymy and cartography for ease of operator training. Command entry shall be acknowledged by the computer.

2.7.1 Interactive Communications

A conversational command protocol should be maintained, using terse "natural" language and avoiding the use of abstract codes and obscure mnemonics. Abbreviations shall be allowed wherever possible. Commands shall be short so errors are corrected simply and a reasonable tempo is maintained. If acronyms are used, they shall be meaningful to the users without difficult memorization, such as PRT (print) rather than FUN 1 (function 1).

Error messages shall be meaningful and informative and shall indicate the appropriate corrective action. Manual data entry shall be highly user oriented. The computer system shall give help when requested. Control of the processing tempo should always belong to the user. The behavior of the computer should appear to be consistent under all circumstances.

The system shall adapt to the ability of the user. The user should be able to control the length of cues or error messages to suit his facility with the system. In addition to the user's control of message lengths, the computer could make some automatic adjustments. Longer, more elaborate messages could be supplied if the user requests help frequently or makes more than a few errors. Redundancy in the dialogue shall be avoided or reduced, especially as the user becomes more familiar with the system.

2.7.2 Errors and Changes

Commands with major effects (irreversible change or slow recovery) shall never be defaults and shall not be easy to initiate accidentally. The system shall allow the user to preview a change before it becomes permanent, and allow for immediate and easy correction of errors or unwanted action. The system shall allow complete or partial cancellation in midtask so that the user can immediately proceed with what he wants to do.

2.7.3 Device Responses

The echo response to key depressions shall be immediate, about 50 msec. For minor actions, the reponse times shall be about 1 sec., but 2–4 sec. are tolerable. The response time for major actions (rearrange display or reformat a graph) are (and the user typically expects) longer and more variable, up to 10 sec.

2.7.4 Tasks and Feedback

Each task must have a definite beginning and end. After each task the system must return to a clearly defined "home state." The sequence in which information is presented shall be logical, in terms of the display itself and in terms of the user's task.

Spacing and blanks in a display are important to maintain logical sequencing, to reduce clutter, and to aid in recognition of items of information. Within a given action the user should only need to focus or concentrate on one given area of the screen.

It shall be possible for the experienced operator to suppress lengthy and repetitive menus, even though they are deemed appropriate for the novice.

3.0 DOCUMENTATION

3.1 Deliverable Documentation

A master index of deliverable documentation, software, and hardware, and final copies of documentation shall be delivered 60 days before hardware/software delivery. A draft copy of the documentation shall be delivered 120 days before hardware/software delivery. All documentation shall be in accordance with DoD Standard 7935.1-S [2] and shall include items discussed below.

3.1.1 Installation Information

Drawings and data indicating the space requirements, placement of units, floor loading, electric power, and other information needed to prepare for the installation of the equipment shall be provided at least six months before hardware delivery.

3.1.2 Test Procedure Results

Documentation of the procedures used to demonstrate compliance with this specification, and records proving that such compliance was demonstrated prior to shipment and acceptance, shall be provided at the time of delivery.

3.1.3 Software Documentation

Other than proven, commercially-available software packages, all software must be documented completely. Software documentation must describe debugging aids, utility routines, diagnostic routines, and operating system. In addition to the requirements specified in [2], all application software shall be documented in the manner described in Appendix B. A detailed index and flowchart of all software modules to be delivered and their degree of documentation shall be included in the implementation plan. Eight copies of the final documentation must be supplied. Only three hardcopy program listings need be supplied.

3.1.4 Operator's Documentation

This shall include a manual that describes operating the system and contains operator maintenance procedures. It shall be in a form easily understandable by the operator. A draft copy of the manual shall be furnished for DMA review before printing.

3.1.5 Maintenance Manuals

Five copies of a comprehensive maintenance package shall be included to test, detect and isolate malfunctions in all equipment units or elements specified and delivered by the developer. Documentation pertaining to all peripherals supplied by the contractor, subcontractors, and vendors on all supplied equipment and subsystems shall be included. The package shall contain:

- a system manual of good commercial quality,
- CPU and peripheral manuals of good commercial quality,
- complete parts list in each of these manuals.

3.1.6 Parts Lists

A list of those parts necessary to maintain the system for a period of one year shall be provided. Cost data must be provided for each item listed so the parts may be purchased following first equipment delivery.

Price data for support items required for maintenance, calibration, and alignment of equipment, such as alignment disks for disk units, shall be included so the items may be purchased following first equipment delivery.

It shall be certified that all engineering changes announced by the Original Equipment Manufacturer (OEM) have been installed on the equipment at the time of installation and that equipment is eligible for a maintenance contract by the OEM.

3.2 Miscellaneous Documentation

All future issuances (such as follow-up bulletins, diagnostic listings, and general documentation changes) published by subcontractors or material suppliers shall be passed to the DMA Maintenance Control Branch during the life of the system.

3.2.1 Engineering Drawings

Engineering drawings prepared by any subcontractors for fabricating or assembling system components shall be delivered under the contract, as well as layout drawings showing interconnections and mechanical interfaces. The drawings shall be prepared using good commercial engineering practices.

4.0 ACCEPTANCE TESTING

4.1 Test Plans and Procedures

A Preliminary Acceptance Test Plan for the system shall be submitted. The purpose of the test shall be to demonstrate to DMA the capability, throughput, and reliability of the system. The documentation of the procedures used to demonstrate compliance with specifications, and records proving that such compliance was demonstrated prior to shipment and acceptance shall be provided at the time of acceptance. A Final Acceptance Test Plan is due 6 months prior to hardware/software delivery.

4.1.1 DMA Testing

In accordance with the proposed system capabilities stated in these Functional Design Specifications (FDS), the Geonames Processing System shall accept input from a variety of digital sources and produce completed geonames products as well as assisting in the daily activities of the DMA. The DMA test plan will include the exercise of all system operations.

4.1.2 Hardware Testing (Mechanical)

The system will be given a thorough visual inspection and examination by DMA maintenance personnel to determine that the quality of all materials and workmanship is in compliance with the requirements of these performance specifications.

4.1.3 Hardware Testing (Electrical)

DMA representatives will observe while the system is given electrical tests confirming that all supply circuits are sound. A check shall be made to insure the proper functioning of all buttons, keys, lights, and displays associated with each device.

5.0 SYSTEM MAINTAINABILITY

5.1 Hardware Maintenance

The Geonames Processing System shall be designed for reliable operation (with normal maintenance) for at least ten years. It shall be designed to operate for at least 100 cumulative hours without requiring scheduled maintenance.

The system shall be designed for ease of maintenance. All components shall be easily accessible. Those components which have short scheduled maintenance periods shall be accessible to accommodate quick replacement.

The cost for continuous on-site hardware and software support during the installation period shall be reported to DMA in order that the Government may elect to purchase or not.

5.2 Software Maintenance

Maintenance shall be provided for all delivered software. Maintenance shall include corrections of all software errors identified in accordance with standard procedures. In addition, all vendor updates to standard off-the-shelf software issued during the maintenance period shall be provided. Documentation shall be updated in accordance with the documentation standards in Section 3 for all software modifications.

6.0 PERSONNEL IMPACTS (1)

Staffing requirements for the Geonames Processing System fall into the two categories of Applications and Systems Support (see Figure 6-1). Required personnel are:

- Data Base Administrator
- System Manager
- Production Manager
- system support staff
    a. system programmer
    b. applications programmer
    c. computer operator
- applications analysts
    a. cartographers
    b. toponymists

6.1 Data Base Administrator

Data base administration may be performed by an individual or by executive committee. Primary responsibilities include establishing and policing standards for data size, format, and usage; administering detailed system documentation; and coordinating user needs in light of current system capabilities and data resource development. System and production statistics are directed to the Data Base Administrator to assist in policy decisions. The role of the Data Base Administrator is further detailed in the GNDB FDS, Volume 2 of this series, Section 2.4.

6.2 System Support

6.2.1 System Manager

The System Manager has expertise in the areas of computer systems and data structures and oversees operational and system support. He/she is familiar with the logical and physical design of the GNDB and with system and applications software. His/her major function is to oversee continuing software maintenance and upgrades in system and applications programming.

6.2.2 System Support Staff

The system support staff performs the software maintenance and upgrade tasks dictated by the System Manager. The support staff is comprised of a systems programmer, an applications programmer, and a computer operator.

6.3 Applications

6.3.1 Production Manager

The Production Manager oversees daily applications processes such as toponymic research and geonames product generation.

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(1) This section was written with the assistance of Dr. Alan Barnes, Planning Systems, Inc., McLean, Va.

6.3.2 Applications Analysts

Applications analysts are the toponymists and cartographers currently involved in geonames product generation at DMA centers.

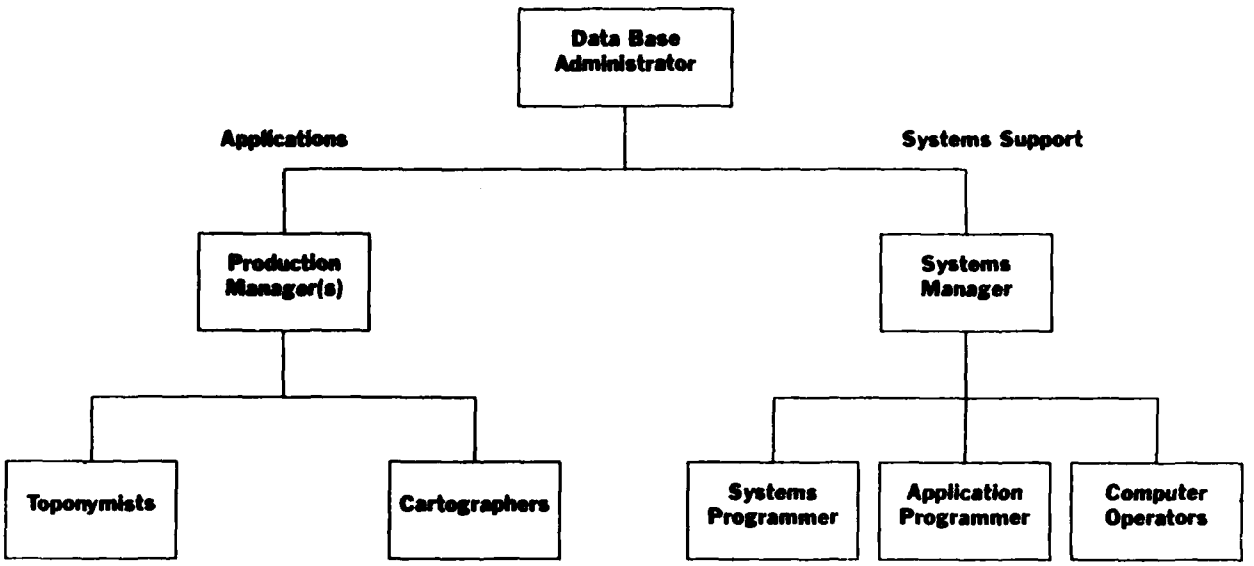

Figure 6-1. Geonames Processing System Personnel.

7.0 TRAINING

7.1 General

Training courses shall include manuals, handouts, and other training aids. These materials shall be over and above the documentation listed in Section 3. Title to all training materials shall pass to the Government without restrictions as to reproduction or reuse. Courses shall not run concurrently.

7.2 Programmer Training

Application programmer training shall be supplied at DMA for up to eight Government pesonnel. Training shall be completed prior to final acceptance of the system. The course shall cover all programs for the system with a complete discussion of their operation, maintenance, and methods of modifications. The course shall also include a total system overview to include such subjects as interaction of hardware and software, mathematics and any numerical methods used in the software.

System programmer training shall be provided for four personnel. The training shall include, but not be limited to, program preparation and execution, operating systems, compilers and assemblers, loaders/linkers, file manager, and other support software.

7.3 Operator Training

Training for applications analysts in workstation operation shall be supplied at DMA. The course will cover all phases of operation of the system and shall provide for each analyst to become sufficently knowledgeable about the system to efficiently use all applications programs. A discussion of the analyst's manual shall be included to familiarize the analyst with its use. The system shall be available for practical experience. Twenty analysts shall be trained.

Training to operate processing hardware shall be provided for the DMA personnel. Training for four operators shall be provided.

7.4 Production Supervisor Training

Training shall be provided for ten individuals in the functions and use of the Job Manager as outlined in the FDS's. These individuals shall also be given a sufficient overview and summary of the system capability to fnlly appreciate their responsibility. At least three individuals shall be fully trained prior to beginning of acceptance testing.

7.5 Maintenance Training

Maintenance training shall be provided at DMA for five Government personnel. Prerequisite for the course will be a knowledge of electronics and fundamentals of programming. The course shall include a system overview, theory of operation, preventive and remedial maintenance, a thorough discussion of the calibration and diagnostic programs used by the system, a review of all circuit diagrams and maintenance manuals, and a review of preventive maintenance procedures.

At the completion of the maintenance training, personnel shall be capable of performing both preventive and remedial maintenance on all the equipment specified in the system.

8.0 MISCELLANEOUS REQUIREMENTS

8.1 Transportability

The system, in a nonoperating condition and when packaged for shipment, shall be designed to be transportable by common carrier. Units shall be capable of intrafacility movement by standard fork lift, in a packaged condition, fitting through an opening 80 inches high by 71 inches wide.

8.2 Materials, Parts, and Processes

System materials, parts, and processes shall be consistent with industry standards for high quality equipment and shall meet the life requirements of the equipment as specified.

8.3 Emanations

The system design shall utilize good electromagnetic compatibility design practices in suppressing any potential noise generating (radiated and conducted) sources. Components available with noise suppression features shall be used if possible.

8.4 Radio Frequency Interference (RFI)

The specified equipment shall be protected against Radio Frequency Interference (RFI) so circuits are not adversely affected by RFI or voltage transients. All cabling outside of cabinets will be shielded. Each shield shall include a bare drain wire. This drain wire shall have a lay such that it will make contact with the shield throughout its length. A drain wire throughout the cable is not required in braided copper shielded cable.

8.5 Product Markings

The system and all components shall be specified with appropriate markings containing product name, manufacturer's name, model number, serial number, power requirements, BTUs, etc.

8.6 Workmanship

The system and all its parts shall be fabricated and finished in a professional manner.

8.7 Safety Requirements

The equipment should have the lowest noise emission levels that are technologically and economically feasible and compatible with performance and environmental requirements. Noise levels (continuous or intermittent) shall not exceed 70 decibels A-weighted sound pressure level (dba) for 8 hours in any 24-hour period.

Access areas shall not expose operators to moving parts during machine operation or when operator access covers are open. Limit switches shall be provided for all motions to prevent damage to the equipment in the event of component malfunction or operator error.

APPENDIX A

REFERENCES

1. Defense Mapping Agency, Standard Linear Format (SLF) for Digital Cartographic Feature Data, 16 May 1983.

2. DoD Standard 7935.1-S, Automated Data Systems Documentation Standards, February 1983.

3. Federal Information Processing Standards Publication (FIPS PUB) 1, Code for Information Interchange.

4. Federal Information Processing Standards Publication (FIPS PUB) 15, Subsets of the Standard Code for Information Interchange.

5. Federal Information Processing Standards Publication (FIPS PUB) 25, Recorded Magnetic Tape for Information Interchange (1600 CPI—Phase Encoded).

6. Federal Standard 1003, Telecommunications: Synchronous Bit Oriented Data Link Control Procedures (Advanced Data Communication Control Procedures).

7. Federal Standard 1031, Telecommunications: General Purpose 37 Position and 9 Position Interface Between Data Terminal Equipment and Data Circuit Terminating Equipment.

8. Federal Information Processing Standard Publication (FIPS PUB) 16-1, Bit Sequencing of the Code for Information Interchange in Serial-by-Bit Data Transmission.

9. Federal Information Processing Standard Publication (FIPS PUB) 17-1, Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the Code for Information Interchange.

10. Federal Information Processing Standard Publication (FIPS PUB) 18-1, Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication in the Code for Information Interchange.

11. Federal Information Processing Standard Publication (FIPS PUB) 22, Synchronous Signaling Rates Between Data Terminal and Data Communication Equipment.

12. Federal Information Processing Standards Publication (FIPS PUB) 36, Graphic Representation of the Control Characters of ASCII.

13. Federal Information Processing Standards Publications (FIPS PUB) 37, (FED-STD 1001O, Synchronous High Speed Data Signaling Rates Between Data Terminal Equipment and Data Communications Equipment.

14. Federal Information Processing Standards Publication (FIPS PUB) 50, Recorded Magnetic Tape for Information Interchange 6250 CPT (246 CPMM), Group Coded Recording.

15. Military Specification 1472C. Human Engineering Design Criteria for Military Systems, Equipment and Facilities.

16. MIL-STD-454, Standard General Requirement for Electronic Equipment.

17. National Electric Code, ANSI/NFPA No. 70-1975 C1.

APPENDIX B

SOFTWARE DOCUMENTATION STANDARDS

Documentation required for all systems or programs written for DMA includes the following:

- system documentation,
- program documentation,
- subroutine documentation,
- comments in the code, and
- appendices.

B.1 System Documentation

The narrative begins with an overview of the system. This shall include system name, programmer, date written, language, purpose, and method. A diagram is also required that describes the overall logic flow of the system. This diagram shall indicate linkages between work flow, job management, procesors, and programs. A description of all files, tables, special tape formats, labeled and blank commons, and math models used shall be included in an appendix to the document. Formats or assignment of specific files for certain functions shall be given. An example of this would be: "Tape 4 is used as output."

The following titles shall be used when applicable:

SYSTEM NAME:	
PROGRAMMER/S:	
DATE:	Date completed—month, day, year
LANGUAGES:	eg. FORTRAN, ASSEMBLER
PURPOSE:	Overall purpose and function of system.
METHOD:	How the system works, including the flow and structure.
COMMON, TABLES, FILES:	Name of all tables and files that are fully outlined in the appendix.
COMPUTER:	

B.2 Program Documentation

This narrative is a description of the main program. It includes a flow chart and an explanation of how the program works. This explanation shall follow the logic of the program and correlate with the comments in the code. All input and output parameters, externals, and error codes shall be included and explained in the system documentation. All blank and labeled common shall be described in an appendix.

The following titles shall be used:

PROGRAM NAME:	
PROGRAMMER:	
DATE:	Date completed
LANGUAGE:	
INPUT:	All input items
OUTPUT:	All output items
PROCEDURE:	
TYPE:	
COMPUTER:	Specify computer or state that it is machine independent.
ERROR CODES:	
COMMON/LABEL COMMON:	Name the Common and list the acquirements, otherwise specify appendix containing the explanation.
EXTERNALS:	

B.3 Subroutine Documentation

This narrative is similar to the program documentation. It shall include the calling sequence plus an explanation of the arguments, and name of calling routine.

The following titles shall be used:

SUBROUTINE NAME:	
PROGRAMMER:	
DATE:	
LANGUAGE:	
CALLING SEQUENCE:	Call Subname (A,B,C)
COMMON/LABEL COMMON:	Same as in program documentation
ARGUMENT DESCRIPTION:	Define in order, explain each item and identify as to input, output, or update. This explanation shall include any unique characteristics of the argument, such as data type, array length and use.
PROCEDURE:	
EXTERNALS:	
INPUT/OUTPUT:	
ERROR CODES:	

B.4 Overall Requirements

All mnemonic names shall be explained. All programs shall be indexed as to function along with cross indexing. The documentation shall be updated when the program is changed. This shall be done by revising the existing document.

B.5 Comments in the Code

The following comments are required in all programs:

a. A paragraph located in the beginning of the code consisting of a brief descripton of the purpose of the routine, input and output variables, and stop codes. This paragraph shall be set off with blank lines.

b. A statement which has the programmer's name and the library where the routine is located (if applicable). The date the program was written shall also be included, along with version and revision dates. Version one is the first production version, after which revisions shall be added without removing the previous lines. This statement shall have the revision number, date, and programmer name. There shall also be a line telling which computer the program is written for, and if it contains non standard code.

c. High level language programs shall have comments describing each function. It is suggested the maximum number of lines of code without comments be limited to ten. A comment line shall precede a call to a subroutine. This line shall tell what the subroutine does. In variable entry point subroutines, there shall be a comment line telling the name of the subroutine which contains the entry point. All comments shall be set off with blank comment lines and the comments shall be indented at least three places from the start of the code.

d. Assembly Language programs shall contain comments following the statements. These comments shall describe the logic, not the instructions. When calling an Assembly subroutine from a program, the storage locations of the subroutine parameters shall be identified by comments in the Assembly routine.

e. All debugging aids such as extra prints and dumps shall be made non-executive statements at the time of acceptance.

f. Updates to source libraries shall be correlated with revision dates.

Example:

VERSION 1
REVISION 1 DATE—PROGRAMMER

B.6 Appendices

A detailed description of all files, tables, special formats of tapes or cards, label and blank common, and the math models used shall be included in the appendix. Each item shall be referenced for easy identification and the items shall be listed as a separate appendix.

All mathematical analyses shall be performed and explained in the software documentation to the extent that the actual code being documented could be written directly from the documentation.

The appendices shall include a detailed description of the format needed to use files, tapes, or tables. Each item making up the file, table, etc., shall be explained as to its function and purpose. Any unique or specific assignment shall also be listed. An example would be: "Tape 2 for input only".

All types of Common shall be listed in the appendix. Each item shall be described as explained under the subroutine documentation for the calling parameters. Any common which is used only between two routines shall be listed and explained with the routine as well as in the appendix. If reusing words in common or arrays for different purposes in a subroutine, this shall be fully explained for each routine.

APPENDIX C

ANALYSIS OF NON-ROMAN SCRIPT PROCESSING

C.1 Overview of Non-Roman Script

Non-Roman scripts fall into three groups:

-alphabets, where characters each represent a given sound or sounds;
-ideographies, where characters represent ideas;
-syllabaries, where characters represent syllables.

C.1.1 Non-Roman Alphabets

The major non-Roman alphabets of interest for names processing purposes are: Arabic, German, Greek, Hebrew, Cyrillic, and Korean. Table C-1 shows an analysis of these alphabets.

Table C-1. Analysis of Alphabets

Alphabet	Upper Case	Lower Case	# Symbols	Digitized
Arabic	28	N/A	28	N
German	29	29	58	Y
Greek	24	24	48	Y
Hebrew	28 (1)	N/A	28	N
Cyrillic	31	31	62	Y
Korean (2)	—	—	—	N

(1) Includes word-ending versions of kaph, mem, nun, pe, and sadi.
(2) Information not available at time of publication. This alphabet is based on Sanskrit forms.

C.1.2 Ideographies and Syllabaries

Chinese, Japanese, and Thai are the important ideographies to consider for electronic names processing. Chinese and Japanese character sets are fundamentally the same, since previous to the introduction of Chinese characters to Japan (at the time of the introduction of Buddhism and Confucianism) there was no written Japanese language.

Chinese characters are called Kanji by the Japanese. There are approximately 5500 Chinese characters of common occurance in modern literature, and far more in classical literature. Many of the Kanji have been simplified. A set of 1850 selected Kanji, called "Toyo Kanji" (current characters), are used in newspapers and official documents. These are unlikely to suffice for names applications.

(3) This analysis of Kanji was taken from A.V. Hershey, "Calligraphy for Computers," U.S. Naval Weapons Laboratory, Dahlgren, VA, August 1967, AD 662398.

Japanese includes two phonetic syllabaries. The phonetic characters are called "kana." The "hiragana" syllabary is used for inflection and the "katakana" syllabary is used for foreign words or telegrams. There are 48 characters in each phonetic syllabary. Some characters may be modified by diacritics (nigori) to make 25 additional characters.

A Chinese character is constructed with one or more parts. A "radical" is contained in every character. There are 214 radicals, many of which are themselves complete characters. Radicals are used as the key to a Kanji dictionary. The index of a Kanji dictionary lists all radicals serially in order of increasing number of strokes. The index references the portion of the dictionary where all characters with that same radical are listed together in order of increasing number of strokes. Thus to look up the meaning of a character in the dictionary the radical is isolated, located in the index, and the corresponding section of the dictionary is scanned.

A Naval Weapons Lab effort (4) resulted in digitization of the katakana and hiragana syllabaries and a set of Kanji characters, selected as follows.

1. Radicals which are also members of the Toyo Kanji list.

2. Characters taught to Japanese children in the first grade.

3. Characters of scientific interest.

C.2 Electronic Processing of Non-Roman Script

Digital text processing tasks can be broken into the areas below.

1. Data capture
2. Storage
3. Retrieval
4. Edit
5. Hardcopy reproduction

The means of character representation within the system dictates the method and difficulty of performing each of the processes listed above. Character representation may be in bit map or image form stored in a character field in the database; or it may be in ASCII code. The impacts of each of these means of character representation are discussed below.

C.2.1 ASCII Representation

ASCII codes exist for all non-roman alphabets and for all ideograms (5,6). The issues surrounding the five major electronic names processing tasks using ASCII codes are as follows.

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(4) ibid. A character found to be a component of two or more compound characters was digitized. If one of a pair of antomnyms was digitized, its opposite was also digitized. A comprehensive digitization was not the goal; merely an illustrative and well balanced character list of characters. It is unknown how this character set compares to the character set required for placenames representation.

(5) Kanji ASCII requires two bytes. If a code does not exist for Thai, one is easily developed.

(6) The Multiset III system currently supports Greek, Cyrillic, and Korean in ASCII, making capture of ideograms the major concern.

C.2.1.a Data Capture

At minimum, one of two new procedures would require development (7):

1. keyboard chording schemes to support each required character set;

2. data entry using a digitizing tablet divided into a matrix of characters (see Figure C-1). A different template would be used for each character set.

Of the two procedures, keyed entry is a reasonable alternative for foreign alphabets. However, ideographic character sets which number well into the thousands require the second form of data entry. Neither procedure holds any risk but represents considerable development and learning time for each character set.

C.2.1.b Data Storage

The non-romanized name is stored in ASCII form in the field of its corresponding Latin-alphabet name. Currently, Kanji is supported by Fujitsu in its AIM/RDB data base. It requires a two byte code. No other such non-roman support is known.

C.2.1.c Data Retrieval

It is a simple matter to query the data base for the non-romanized version of a specified romanized name. One of the data entry devices discussed in Section C.2.1.a would be required to specify the name in its non-romanized form. If alphabetic sorting on the non-romanized names is required, software must be developed for the task. This is non-trivial since sorting on Kanji moy be by telephone book order, stroke number, and a several other different ways.

C.2.1.d Edit

Editing itself is straightforward although awkward using ASCII codes and the data entry devices discussed in Section C.2.1.a. Text display requires digitized symbol forms for raster display. This technology exists in the font digitization procedures developed by ETL. There would be, however, an outlay for labor and quality control since the ideograms digitized are unlikely to be familiar to the digitizer, increasing the risk of error.

C.2.1.e Hardcopy Reproduction

The Multiset III computer typesetter is capable of printing any character given its ASCII code and the correct print wheel. Multiset III answers tabular needs only unless map names are to be placed manually. Names overlays cin be produced either with stick-up type from Multiset III or through digitizing characters for the CRT printhead, as described above.

C.2.2 Bit Map Representation

The alternative to ASCII character representation is treating each non-romanized name as a raster image. The technology and tradeoffs are discussed below.

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(7) Automated character recogntion is not recommended for this application due to numerous form and font variations over the foreign character sets.

C.2.2.a Data Capture

The greatest advantage in bit map character representation is realized in the data capture process. The area of the non-romanized word is raster-scanned, background noise is removed interactively if necessary, and a bit map of the word is character encoded for storage.

C.2.2.b Data Storage

The bit map itself is encoded in character form and stored in the data base. Length of the character string could preclude using certain commercial DBMS'.

C.2.2.c Data Retrieval

It is virtually impossible to retrieve names in a bit map non-roman form for the same reasons that OCR technology is not recommended for data capture. Template matching is unlikely to work due to the many variations in form of non-roman script. Alternate OCR technology would be prohibitive to develop.

C.2.2.d Edit

Editing the raster image could be performed in one of two ways (neither without its problems). The first method is to substitute the incorrect image with a new and correct raster image. A convenient means of raster scanning a small area, possibly via wand, is required.

The second method is to develop softcopy graphic edit software usable by an analyst fluent in the writtten language being edited. The ideal configuration for such detailed line work would not come without development expense.

C.2.2.e Hardcopy Reproduction

A raster hardcopy device is required to print the raster character image. Laser printer/plotters newly on the market could meet tabular hardcopy needs. The CRT printhead could be used for names overlays.

C.2.3 Analysis of Methods

The bit map method is greatly preferred if all types of non-roman script (i.e. both alphabets and ideograms) are required. However, if searching upon, sorting, and to some extent, editing of non-roman names are major requirements the bit map method is unsuitable since it would required complex search and sort algorithms and slow graphic edit methods. The bit map method is recommended if access to the non-roman version of a name only through its romanized version satisfies DMA needs.

The ASCII method of non-roman character representation would require no major technological development. It would require a great deal of labor and practice for interactive non-roman ASCII communication and display, since specialized input devices must be developed and symbols must be digitized for display. There do exist digitized fonts for Cyrillic, Arabic, Greek, and possibly Korean; however digitization of ideograms would impose strenuous labor requirements to development of ASCII support.

Equipment requirements for either method are likely to overlap with equipment requirements fo the Geonames Processing System as a whole.

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This report describes the Geonames Processing System attributes and serves as a basis for understanding between the user and the developer. The subsystems referred to are: Advanced Symbol Processing, Advanced Type Placement, Geographic Names Data Base, and Automated Alphanumeric Data Entry System.

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